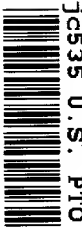


05/11/99



PATENT APPLICATION TRANSMITTAL LETTER
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Commissioner of Patents and Trademarks
Washington, District of Columbia 20231

Mailed May 8, 1999

jc511 U.S. PTO
09/309879
05/11/99

Sir:

Please file the following enclosed design patent/utility patent application papers:

Applicant #1, Name: Anthony Dean Nugent

Applicant #2, Name: HSU, Yie-Yeh

Title: A SENSING DEVICE FOR A SAFETY BELT

(V) Specification, Claims, and abstract: Nr. of Sheets 10

(V) Declaration: Date signed: April 23, 1999

(V) Drawing(s): Nr. of Sheets Enc: (In Triplicate): Formal: 18

(V) Small Entity Declaration Of Inventor(s)
() SED of Non-Inventor/Assignee/Licensee

() Assignment; please record and return; recordal fee enclosed.

(V) Check for \$ 380.00 for:

- (V) \$ 380.00 for filing fee (not more than three independent claims and twenty total claims are presented).
- () \$ 40.00 Additional if Assignment is enclosed for recordal.

(V) Return Receipt Postcard Addressed to Applicant #1.

Very respectfully,

1. Anthony Dean Nugent 2. HSU Yie Yeh
Applicant #1 signature Applicant #2 Signature

C/O DANIEL ROBINSON
1867 Ygnacio Valley Rd., #1008 Walnut Creek, CA 94598

Address (Send Correspondence Here)

Express Mail Label # ; Date of Deposit 1995

I hereby certify that this paper or fee is being deposited with the United States Postal Service using "Express Mail Post Office To Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to "Commissioner of Patents and Trademarks, Washington, D.C. 20231."

Signed 1. Anthony Dean Nugent 1. Anthony Dean Nugent
Inventor 2. HSU Yie Yeh 2. HSU, Yie-Yeh

Independent Inventor

Attorney's
Docket No. _____

VERIFIED STATEMENT OF SMALL ENTITY STATUS

Honorable Commissioner of Patents and Trademarks
Washington, D. C. 20231

Sir:

I hereby declare that I am ☐ the sole inventor ☒ a joint inventor of the
invention entitled: A SENSING DEVICE FOR A SAFETY BELT

the invention being described and claimed ☒ in the specification filed herewith, ☐ in the
specification of application Serial No. _____, filed _____
19____; and that I have not assigned, granted, conveyed, or licensed, and that I am under
no obligation under contract or law to assign, grant, convey, or license, any rights in the
invention to any person who could not likewise be classified as an independent inventor if
that person had made the invention, or to any concern which would not qualify as a small
business concern or a nonprofit organization.

I further declare that all statements made herein of my own knowledge are
true and that all statements made on information and belief are believed to be true; and
further that these statements were made with the knowledge that willful false statements and
the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title
18 of the United States Code, and that such willful false statements may jeopardize the
validity of the application or any patent issuing thereon.

Date: April 23, 1999

Anthony Dean Nugent
Anthony Dean Nugent

Independent Inventor

Attorney's
Docket No. _____

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_____;
the invention being described and claimed ☒ in the specification filed herewith, ☐ in the
specification of application Serial No. _____, filed _____
19____; and that I have not assigned, granted, conveyed, or licensed, and that I am under
no obligation under contract or law to assign, grant, convey, or license, any rights in the
invention to any person who could not likewise be classified as an independent inventor if
that person had made the invention, or to any concern which would not qualify as a small
business concern or a nonprofit organization.

I further declare that all statements made herein of my own knowledge are
true and that all statements made on information and belief are believed to be true; and
further that these statements were made with the knowledge that willful false statements and
the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title
18 of the United States Code, and that such willful false statements may jeopardize the
validity of the application or any patent issuing thereon.

Date: April 23, 1999

HSU Yie Yeh

HSU, Yie-Yeh

TITLE OF THE INVENTION

A SENSING DEVICE FOR A SAFETY BELT

BACKGROUND OF THE INVENTION

a) Technical Field of the Invention

The present invention relates to a sensing device for a safety belt, and in particular, to a sensing device which can be connected to the safety belt to sense and to record the pulling force of the safety belt caused by an impact, direction of the impact and the impact force, so as to provide a status proof of fastening the safety belt.

b) Description of the Prior Art

As shown in Fig. 1, the conventional safety belt includes a fastening plate 1 and a fastening seat 2. When the fastening plate 1 is inserted into the seat 2, the safety belt can provide a mere function of holding the user. The conventional belt does not have a sensing function. It is very common that the driver or the passenger forgets to put on the safety belt but he gets into the car. When the car hits a big object, or a great impact has occurred to the car, the driver or the passengers may be hurt if the belt has not been put on properly.

In a school bus carrying a number of school children, it is possible that some school boys play with the belt as if the belt is a toy by frequently releasing and fastening on the safety belt. It may not have sufficient number of guardians in the school bus to look after the children. Therefore, the children without putting on the belt may be hurt if an accident or an impact is caused to the bus. This is because the conventional belt does not have a sensing device to provide a warning signal to the user.

SUMMARY OF THE INVENTION

Therefore, it is an object of the present invention to provide a sensing device for a safety belt, wherein the sensing device can be connected to a safety belt and the sensing device is provided with a enumerating recording switch to provide a enumerating recording signal with respect to seat belt fastening.

Another object of the present invention is to provide a sensing device for a safety belt, wherein the sensing device can be connected to a signal processor to process the signals transmitted from the sensing device.

5 Yet another object of the present invention is to provide a sensing device for a safety belt, wherein a pulling force recording unit is mounted such that the unit can precisely record the instantaneous pulling force of the safety belt when an impact to the car is occurred.

10 It is another object of the present invention to provide a sensing device for a safety belt, wherein an impact status recording unit is provided to the sensing device such that the impact force and the direction of impact can be precisely recorded if an impact to the car is occurred.

15 Yet another object of the present invention is to provide a sensing device for a safety belt, wherein the sensing device is compact and portable.

Another object of the present invention is to provide a sensing device for a safety belt, wherein the sensing device can be mounted together with the fastening
20 seat of any conventional safety belt.

Additional advantages of this invention will become apparent from the description which follows, taken in conjunction with the accompanying drawings.

25

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view of a conventional safety belt fastener.

30 Fig. 2 is a schematic perspective view of a sensing device to be mounted to a safety belt in accordance with the present invention.

Fig. 3 is a perspective view of the sensing device for a safety belt in accordance with the present invention.

35

Fig. 4 is a perspective exploded view of the sensing device in accordance with the present invention.

Fig. 5 is a perspective exploded view of an engaging element of Fig. 4 in accordance with the present invention.

Fig. 6 is a perspective exploded view of the sensing device for a safety belt, indicating the recording indication unit, in accordance with the present invention.

Fig 7 is a perspective exploded view of the sensing device for a safety belt, indicating the pulling force recording unit of the present invention.

Fig. 8 is a perspective exploded view of the pulling force recording unit of Fig. 7 of the present invention.

Fig. 9 is a perspective exploded view of the fastening plate of Fig. 8 of the present invention.

Fig. 10 is a perspective exploded view of the pulling force resistance circuit board of Fig. 8 of the present invention.

Fig. 11 is a perspective view of the elastic mounting unit of Fig. 8 of the present invention.

Fig. 12 is a perspective exploded view of the impact recording unit of Fig. 7 of the present invention.

Fig. 13 is a schematic view illustrating the movement of the pendulum of Fig. 12 of the present invention.

Fig. 14 is a circuit diagram of the enumerating of fastening the present invention.

Fig. 15 is a circuit diagram of impact time memory of the sensing device of the present invention.

Fig. 16 is a circuit diagram of the pulling force indication of the sensing device of the present invention.

Fig. 17 is a circuit diagram of the impact force indication of the sensing device of the present invention.

Fig. 18 is a perspective view of a signal processor in combination with the sensing device mounted with the safety belt.

5

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 illustrate a conventional safety belt. In application, the belt provides a pulling protection to the wearer. The conventional safety belt does not provide a
10 sensing device to record the status of application of the belt.

Referring to Fig. 2, there is shown the sensing device to be mounted to the safety belt. As shown in Fig. 3, the sensing device 3 has one protruded fastening loop 6 insertable into a mounting slot 91 of the fastening seat 2 of the safety belt. One
15 edge of the sensing device 3 is provided with a fastening recess 92. A releasing button 25 is mounted on one lateral face of the sensing device 3 for the releasing of the fastening plate 1 of the safety belt from the sensing device 3. On the opposite lateral side of the sensing device 3, a stencil plate 26 with function indication is provided. Along one edge of the sensing device 3, a signal socket 30 is mounted.

Referring to Fig. 4, there is shown a perspective view of the sensing device of the present invention. The sensing device 3 comprises a tightening unit 100 for mounting with the fastening plate 1 of the safety belt; a pulling force recording unit 200 for mounting to the fastening seat 2 of the safety belt; an impact status recording unit 300; a fastening status recording unit 400; a record indication unit 500.
20

25

The tightening unit 100 comprises an engaging element 101 and a releasing button 25. The engaging element 101 is mounted adjacent to the lateral face close to the releasing button 25 for engaging with the fastening plate 1 of the safety belt. As shown in Fig. 5, the engaging element 101 comprises a fastening board 28 having one
30 end mounted with a rotating shaft 29 having a twisting spring 82. The reverse twisting of the spring 82 causes the fastening board 28 to produce an engaging action.

Fig. 6 is a perspective exploded view of the sensing device 3. On an indication circuit board 72, there are mounted with two timing indication circuits 102,
35 103, a time adjusting button 104, an impact indication light 105, at least one battery 106, a plurality of ICs 107, and a signal line connector 108. At normal circumstance, the two timing indication circuits 12, 103 record time simultaneously and are controlled by the time adjusting button 104. If an impact is occurred, one timing

indication circuit 102 receives an impact signal from other units, such as units 200, 300. At this moment, time recording stops so as to indicate the impact time. The other time indication circuit shall not be affected but continuous its time recording.

5 At an appropriate position on the board 72, a plurality of screws 73 are employed to fasten the board 72 together with the pulling force recording unit 200. The screws 73 pass through the screw holes 74 and shaft pads 75 prior to mounting the board 72 with the unit 200.

10 As shown in Figs. 7, 9, 10, 11, a clipping frame 10, and a mounting frame 14 contain a fastening loop 6 protruded from one end of the frame 10, and an elastic mounting unit 109. A number recording switch 41 is provided on the mounting frame 14. This switch 41 is connected to the signal socket 30 so as to transmit an alarming signal if the belt has not been fastened and to transmit the enumerating of fastening
15 the belt signal.

The elastic mounting unit 109 comprises an elongated plate 110, a circuit board 4 having the function of converting the pulling force into resistance, a plurality of compression springs 5, and a stopping gear assembly 8. The stopping gear assembly 8 has a gearing element 112 mounted with a peg 7 having being inserted
20 with a twisting spring 82. The gearing element 112 faces a positioning ratchet 9. The two ends of the peg 7 are mounted perpendicularly with the clipping frame 10 and the mounting frame 14. The gearing element 112 is positioned to the ratchet 9 when the elongated plate 110 is pulled out. The two ends of the spring 5 respectively urge the spring support 93 and the resisting plate 11, such that the elongated plate 110 is
25 positioned in between the clipping frame 10 and the mounting frame 14. When at great impact, the impact force produces a greater displacement force than the spring 5. The support 93 presses the spring 5 such that the elongated plate 110 moves slightly. The circuit board 4 is mounted adjacent to the elongated plate 110. As shown in Fig. 10, a conductive layer 50, a plurality of variable resistance layer 51, two parallel high
30 impact conductive layers 52, 53 and a signal output connector 33 are mounted on the board 4. The variable resistance layer 51 is parallel to the conductive layer 50. These layers 50, 51 can contact with the spring plate 34 and the conductive layers 52, 53 are further away from the spring plates 34, 35.

35 When the displacement of the elongated plate 110 is great, the spring plate 35 touches the conductive layers 52, 53 to output a strong impact signal. These layers 50, 51, 52, 53 transmit the conductive signals, via the signal output connector 33, to the record indication unit 500.

As shown in Fig. 11, if an impact is occurred, the fastening loop 6 is pulled out to a distance which has corresponding layers 50, 51, 52, 53 and are conductive and output a corresponding resistance value.

5

As shown in the figure, the impact status record unit 300 is connected to the elastic mounting unit 109 which is connected to the record indication unit 500. As shown in Fig. 12, the unit 500 has a circuit board 16 comprises a pendulum 96 having a heavy weight body 18 at one end. The pendulum 96 is made from a conductive material. At the end closer to the heavy weight body 18, a fastener body 114 having a pressing tip 59 to press the circuit board 16 is provided. At the lateral side of the fastener body 114, a pressing contact 58 is provided. A thin spring 19 is mounted across the edge of the board 16. On the arc-shaped path formed by the swinging movement of the pressing tip 59, a plurality of engaging recesses 61 is formed on the board 16. On the arc-shaped path formed by the swinging of the pressing contact 58, a resistance membrane 60 is formed on the board 16. A pair of mounting hooks 17 are mounted on the board 16 to engage to one end of the thin spring 19. The other end of the spring 19 is connected to the pendulum 96, such that the board 16 is connected to the pendulum 96 and formed a conductive circuit, which is connected, together with the circuit of the resistance membrane 60, to the connecting point of the record indication unit 500. Thus, after the pendulum 96 is mounted to the circuit board 16 and by means of the balancing effect of the two thin springs 19, the pendulum 96 is maintained at the center. Thus, the pendulum 96 is used as a switch by means of sensing vibration moment.

25

Referring to Fig. 3, a schematic view illustrating the movement of the pendulum. When an accident is occurred, the instantaneous force produced by the impact is greater than the pulling force of the thin spring 19 such that the pendulum 96 swings to a position with minimum kinetic energy. The pressing tip 59 is engaged with the engaging recess 61 such that the pendulum 96 is deadlly engaged and fixed. At the same time, the pressing contact 58 slides to contact with the resistance membrane 60 at the corresponding position such that the resistance value at that position is transmitted out. The impact force, and direction of impact can be converted into a corresponding resistance value which can be electrically analyzed and the indication of impact is shown in pound.

35

Figs. 14 to 17 are circuit diagrams, and the structure, and the principle are corresponding to the above described recording indication unit 500.

CLAIMS

1. A sensing device for a safety belt comprising
- 5 a tightening unit having a fastening plate;
- a pulling force recording unit for mounting to a fastening seat of the safety belt;
- 10 an impact status recording unit;
- a recording indication unit; and
- wherein the pulling force recording unit comprises a clipping frame
- 15 containing a fastening loop with one end protruded out from the sensing device and an elastic mounting unit capable of changing the resistance value when a pulling force is exerted, the impact status recording unit comprises a pendulum mounted on which changes the resistance value of circuit board by the swinging of the pendulum, and the fastening status recording unit comprises an enumerating sensing
- 20 switch, and electrical signal and resistance of the above units are transferred to the record indication unit.
2. The sensing device for a safety belt as set forth in Claim 1, wherein the
- 25 tightening unit comprises an engaging element and a releasing button, and a partial of the releasing button is exposed laterally and the engaging element is adhered to the lateral face of the releasing button to elastically mount the fastening belt of the safety belt.
3. The sensing device for a safety belt as set forth in Claim 2, wherein the
- 30 fastener engaging body comprises a fastening plate, and one end of the plate is mounted with a rotating shaft having a twisted spring, by means of the spring urging the fastening plate, an elastic engaging is formed.
- 35
4. The sensing device for a safety belt as set forth in Claim 1, wherein the record indication unit comprises two time indication batteries, a time adjusting button, an impact force indication light at least one battery, a plurality of ICs and an

A sensing device for a safety belt comprising a tightening unit having a fastening plate; a pulling force recording unit fastening seat of the safety belt; an impact status recording unit; a record indication unit; and a cartridge housing containing these units therein, wherein the pulling force recording unit comprises a clipping frame containing a fastening rim with one end protruded out therefore , and an engaging element capable of changing the resistance value when a pulling force is exerted, the impact status recording unit comprises a pendulum, on a circuit board, which changes the resistance value of the circuit board by the swinging of the pendulum, and the fastening status recording unit comprises an enumerating sensing switch, and the electrical signal and resistance of the units are transferred to the record indication unit.

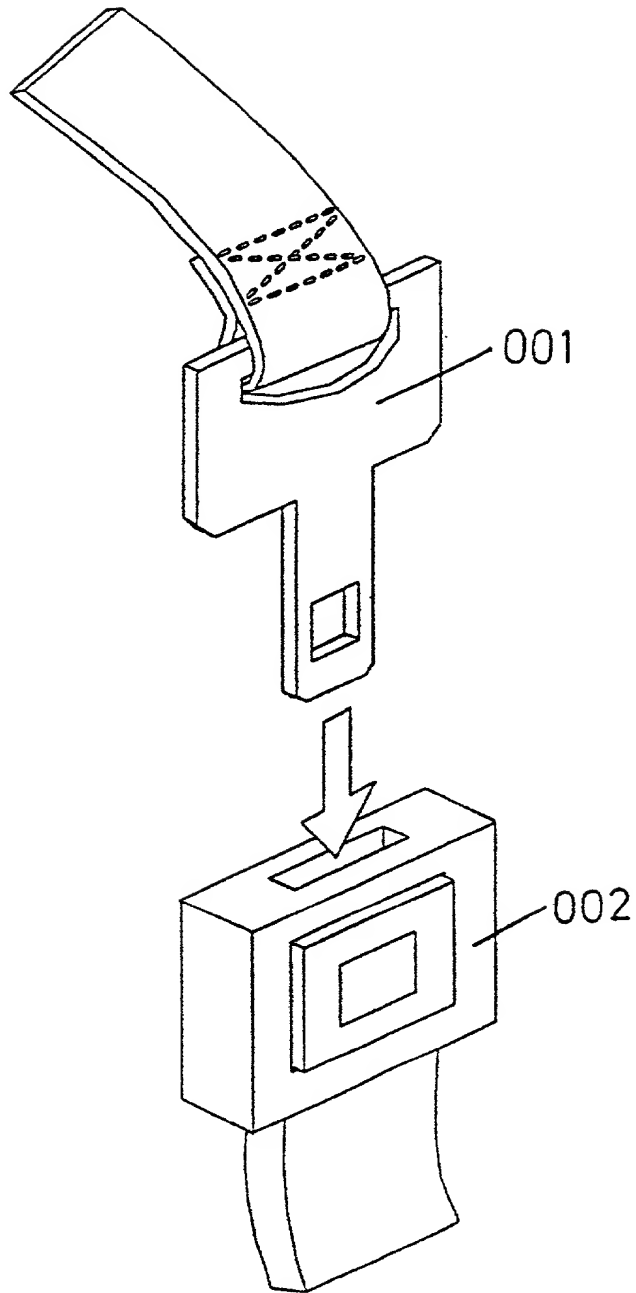


FIG. 1

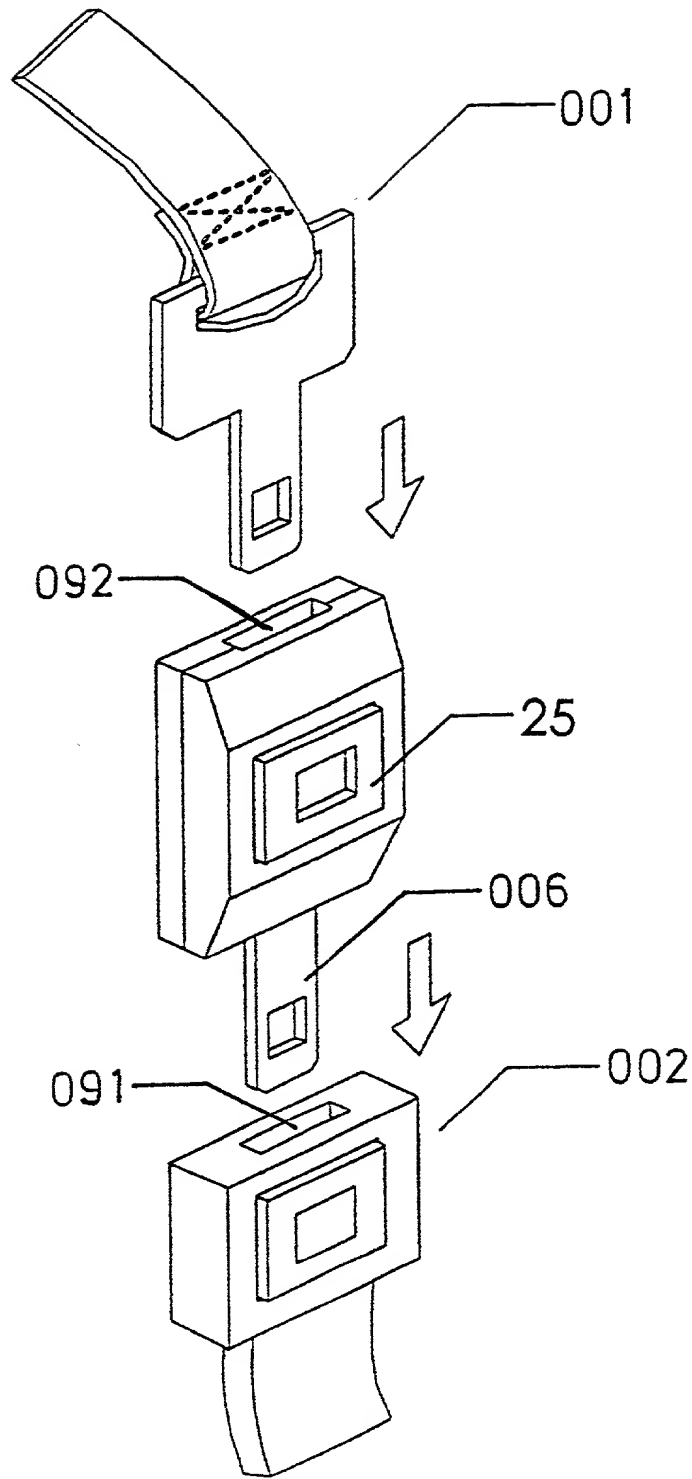


FIG. 2

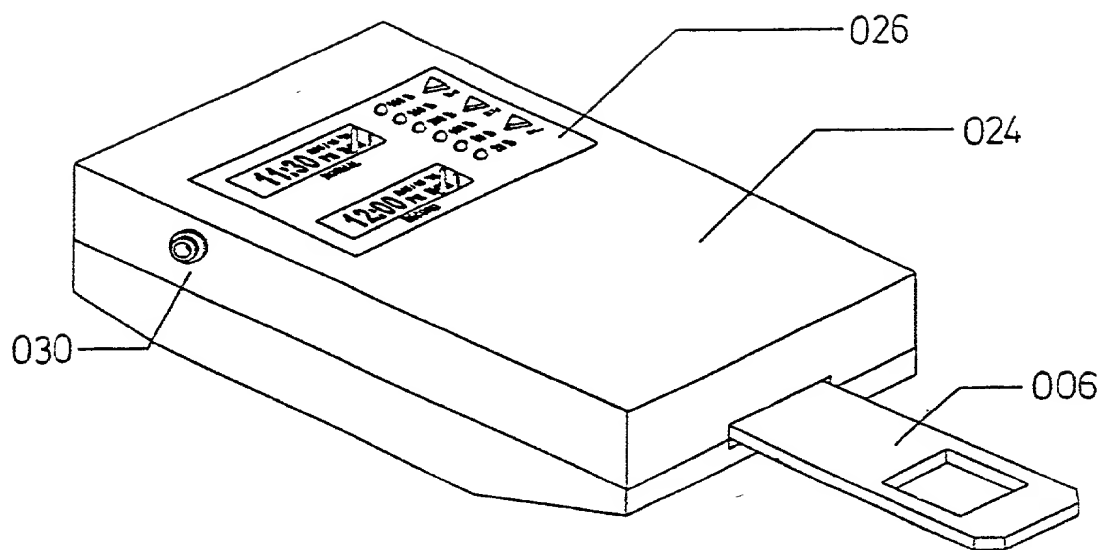


FIG. 3

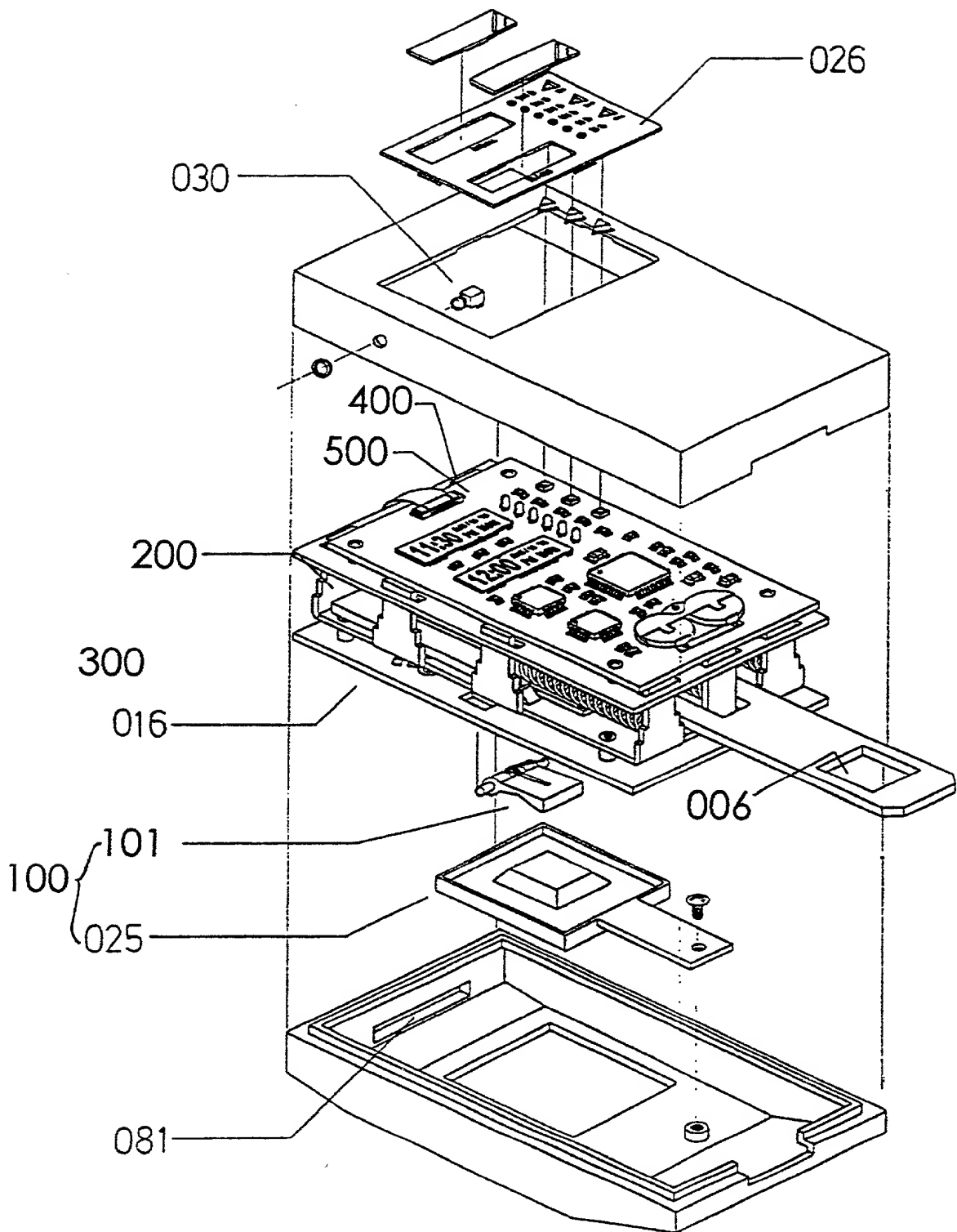


FIG. 4

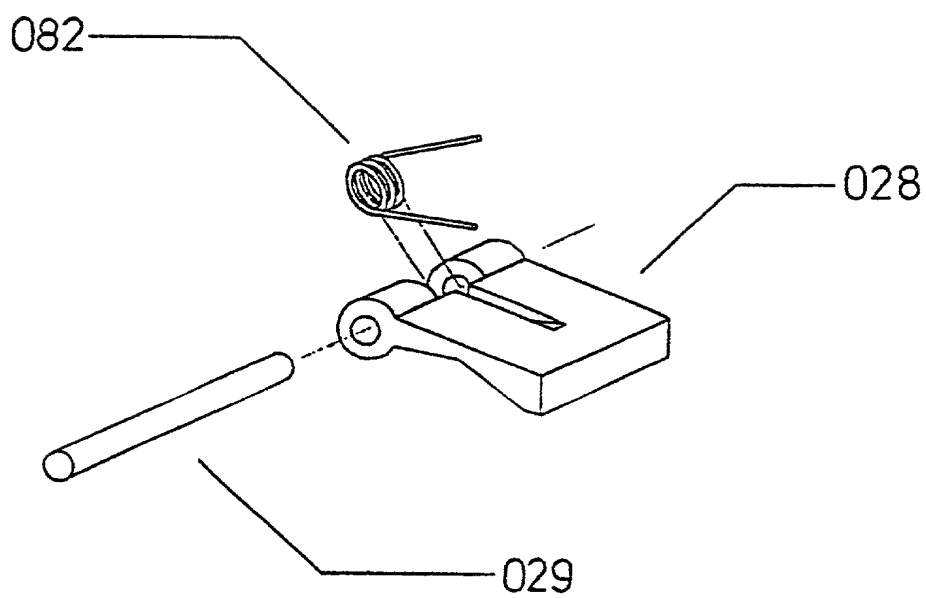


FIG. 5

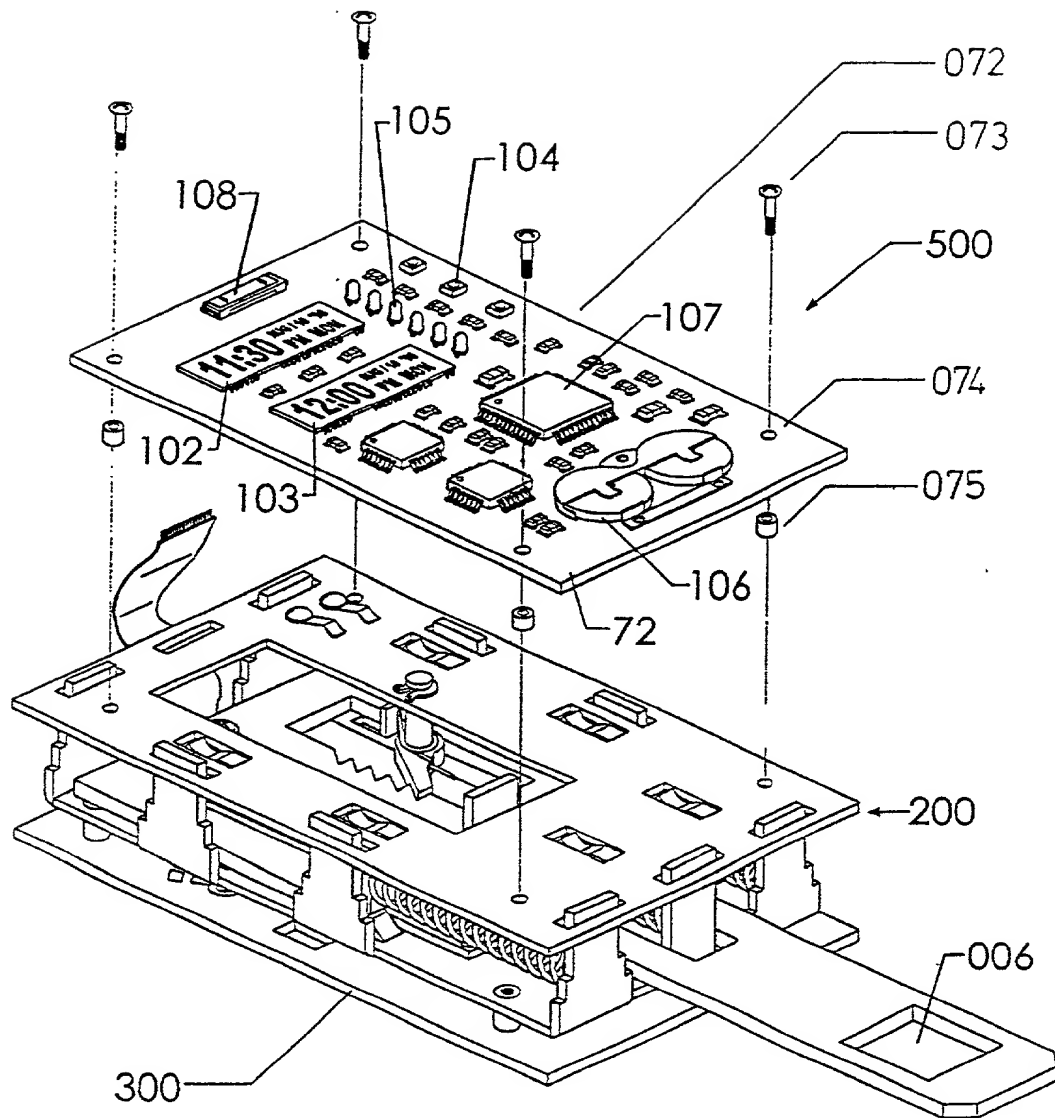


FIG. 6

66450 6280800

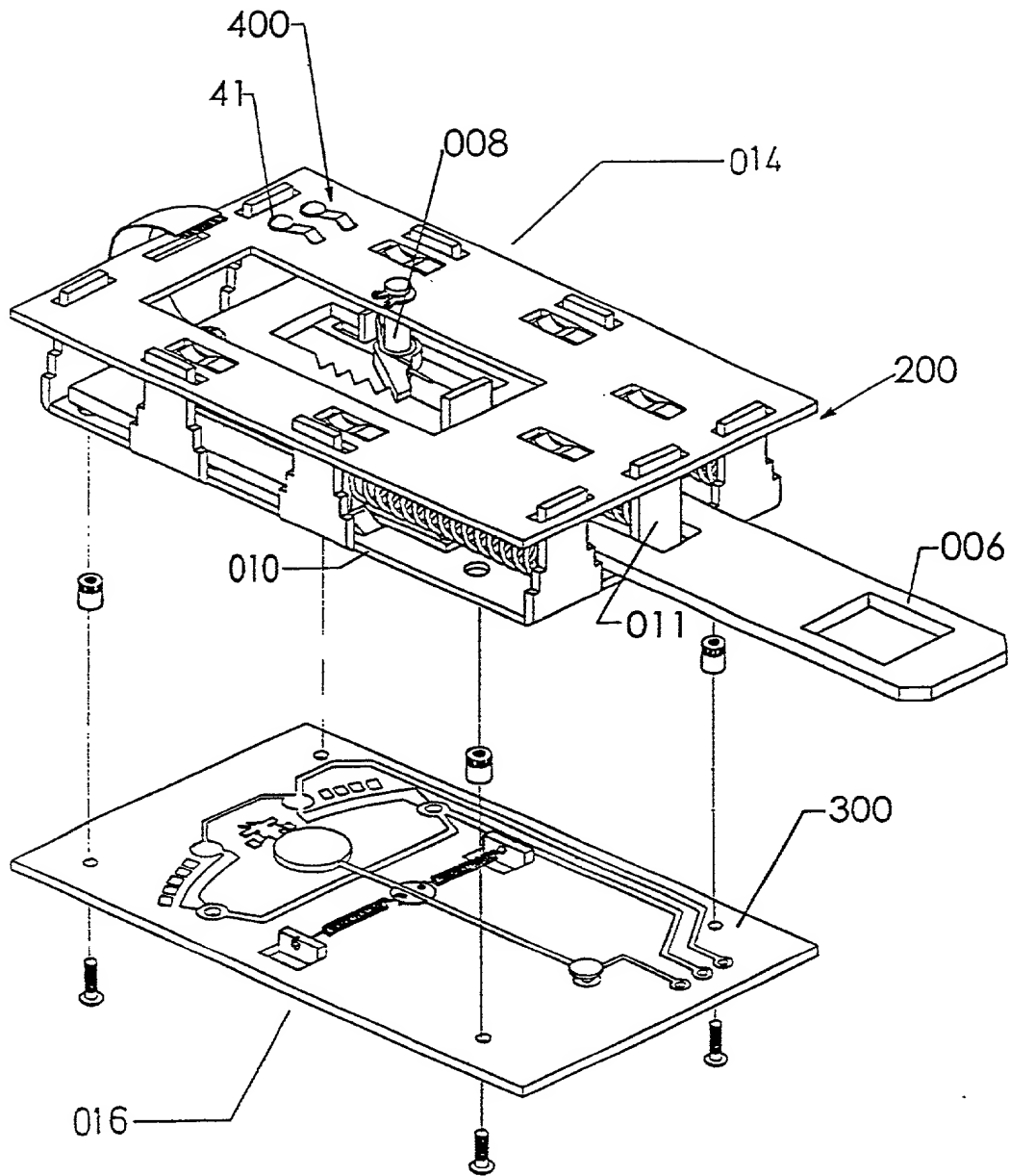


FIG. 7

[illegible]

FIG. 8

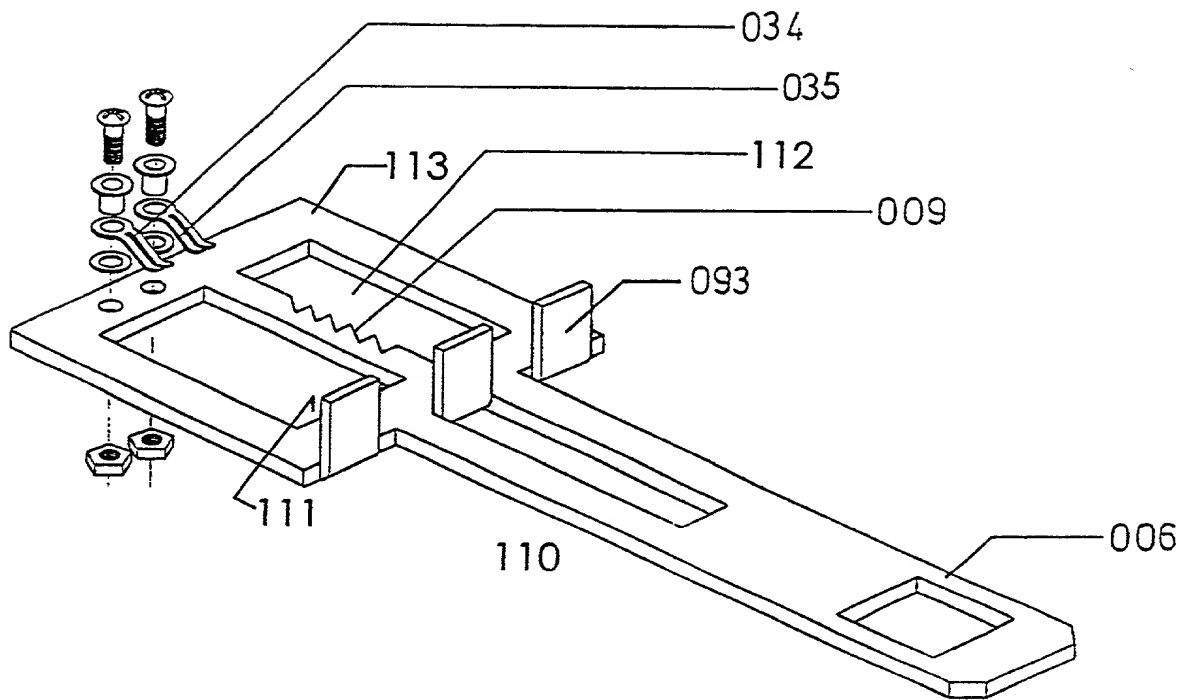


FIG. 9

66150 62600000

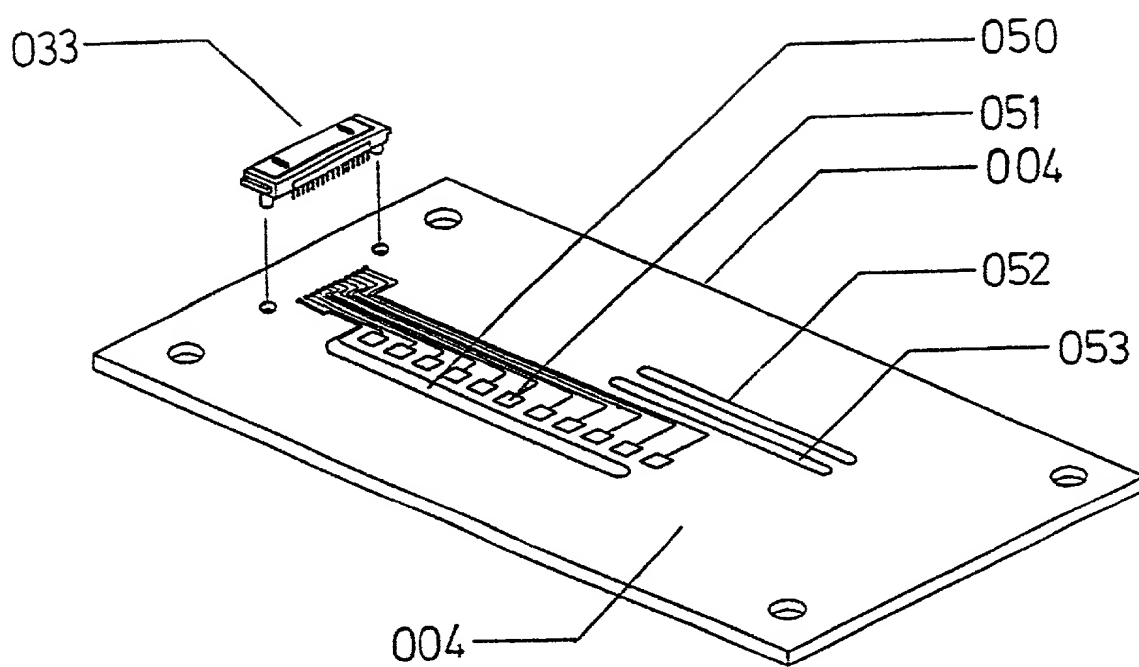


FIG. 10

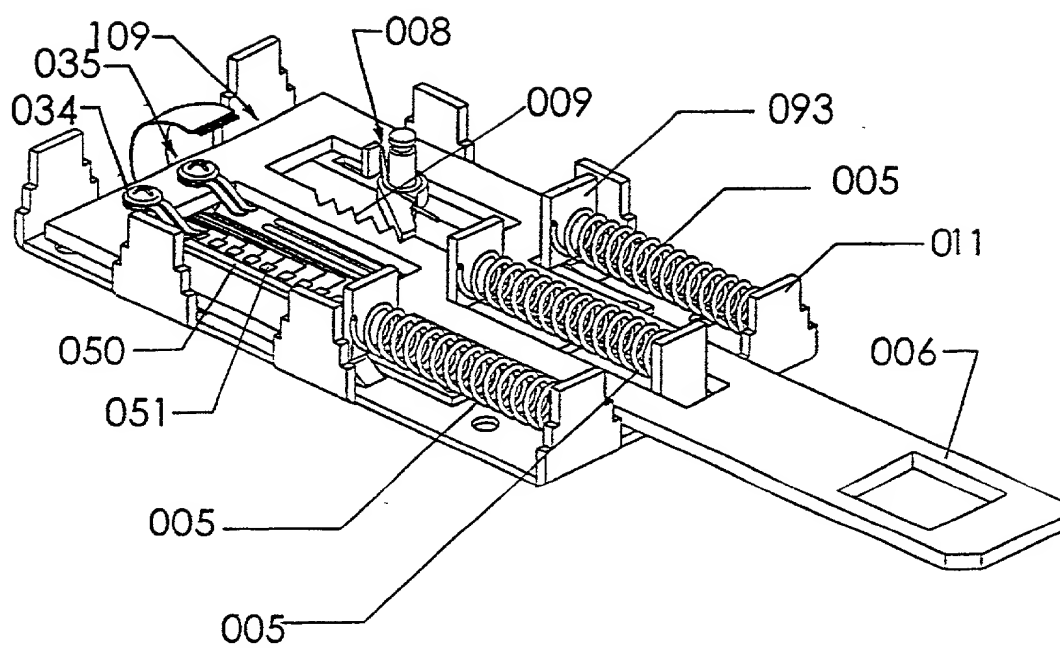


FIG. 11

66150 6280000

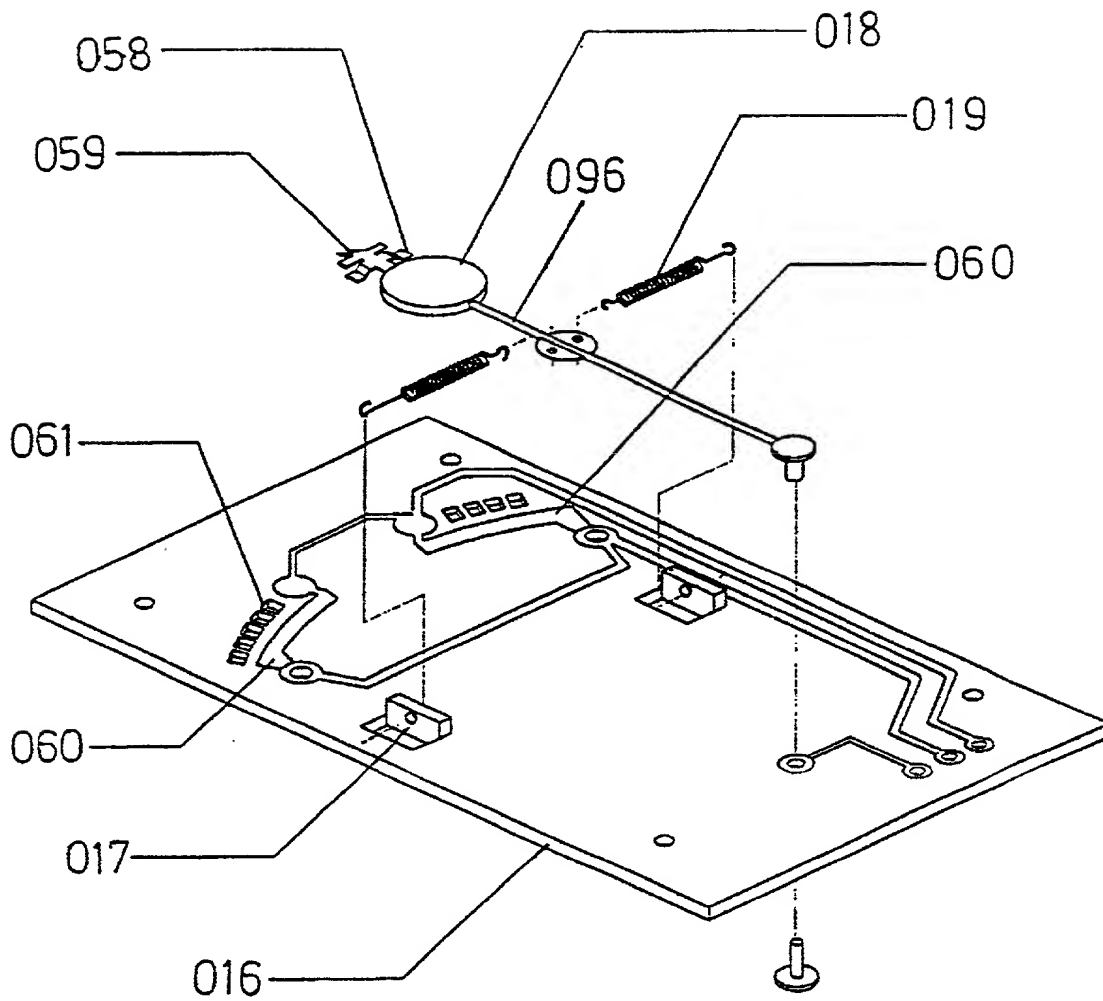


FIG. 12

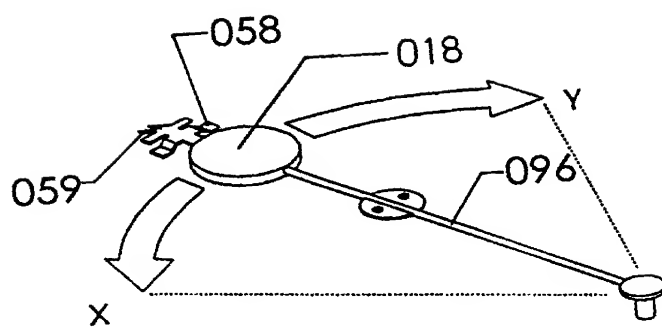


FIG. 13

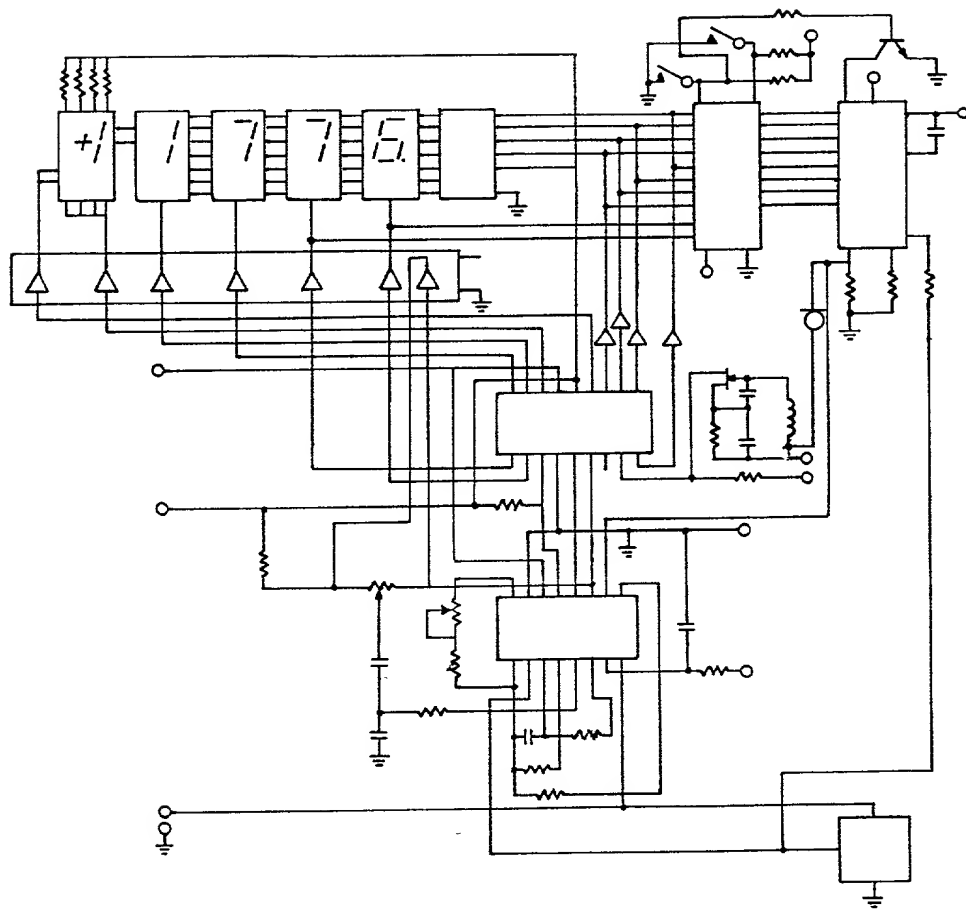


FIG. 14

664450 2430260

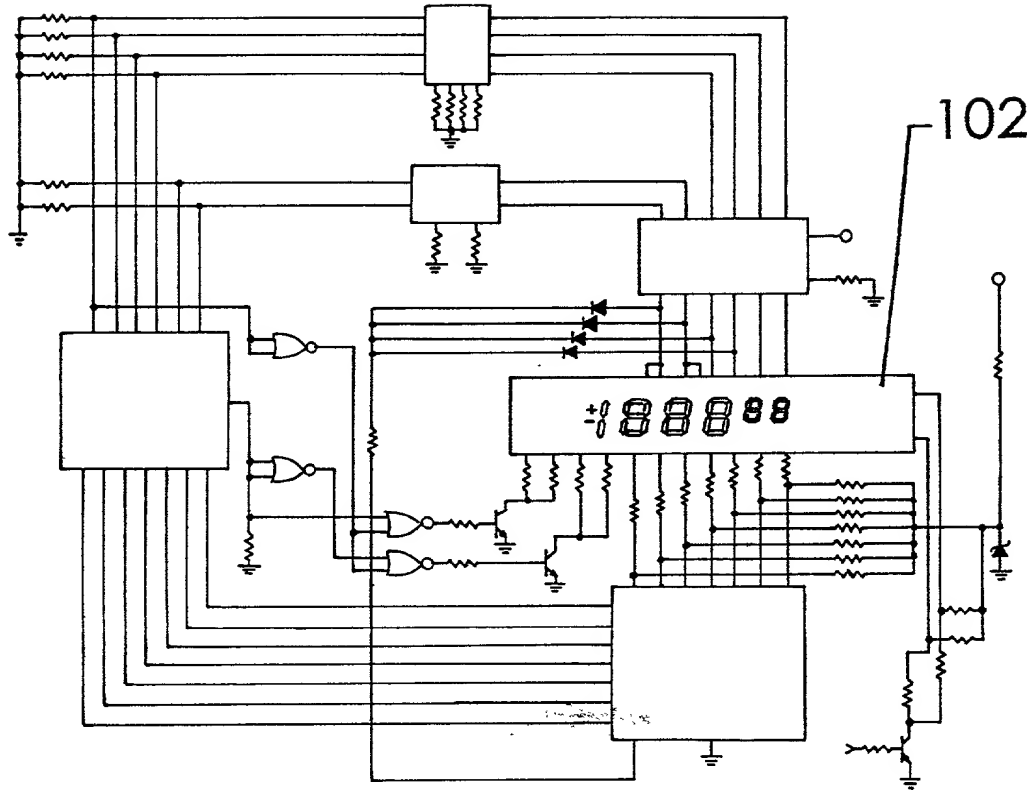


FIG. 15

FIG. 16

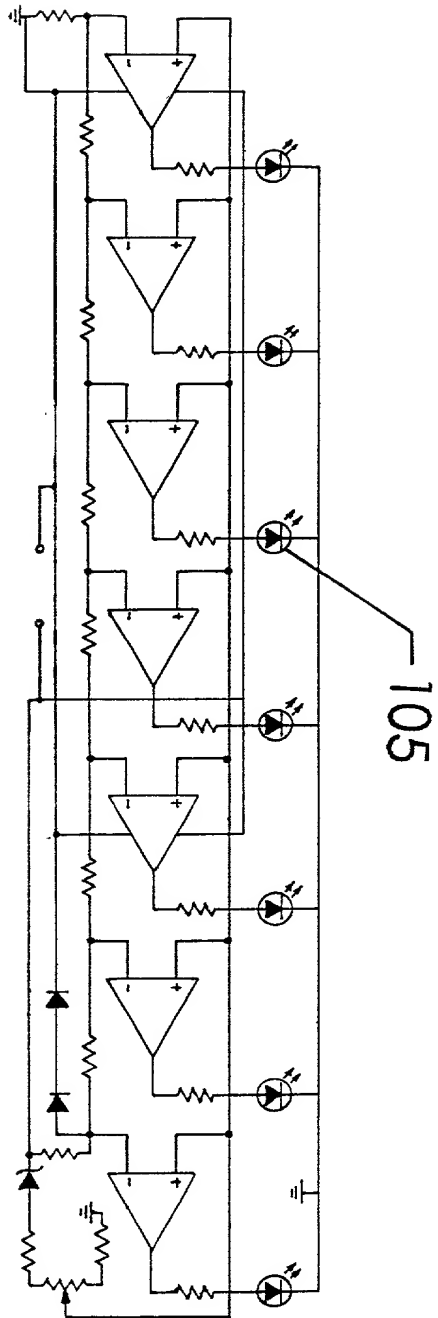


FIG. 17

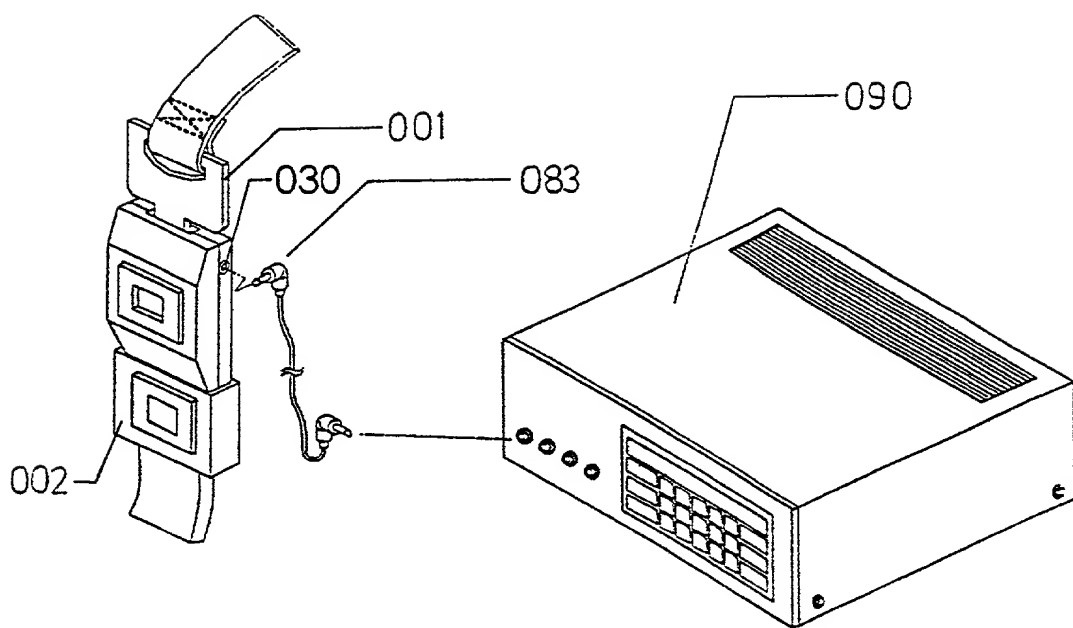


FIG. 18

Declaration For Patent Application

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor(if only one name is listed below) or an original, first and joint inventor(if plural names are listed

below) of the subject matter which is claimed and for which a patent is sought on the invention entitled _____

A SENSING DEVICE FOR A SAFETY BELT

the specification of which

(check one) ☒ is attached hereto.

☐ was filed on _____ as

Application Serial No. _____

and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

(Number) (Country) (Day/Month/Year Filed)

☐ Yes ☐ No

(Number) (Country) (Day/Month/Year Filed)

☐ Yes ☐ No

(Number) (Country) (Day/Month/Year Filed)

☐ Yes ☐ No

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)

(Filing Date)

(Status) (patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status) (patented, pending, abandoned)

And I hereby appoint as principal attorneys

Please direct all communications to the following address:

C/O DANIEL ROBINSON

1867 Ygnacio Valley Rd.,

1008 Walnut Creek, CA 94598

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor Anthony Dean Nugent

Inventor's signature

Anthony Dean Nugent

April 23, 1999

Residence

Louisiana 70510

Date

Citizenship

U.S.A.

Post Office Address

P.O. Box 82-144, Taipei, Taiwan

(Supply similar information and signature for second and subsequent joint inventors.)

Full name of second joint inventor, if any HSU, Yie-Hen
 Second inventor's signature Hen Yie Yeh Date April 23, 1999

Residence Taiwan

Citizenship _____
Post Office Address P.O. Box 82-144, Taipei, Taiwan

Third inventor's signature _____ Date _____

Citizenship

Post Office Address _____

Fourth inventor's signature _____ Date _____

Citizenship _____

Post Office Address _____

Fifth inventor's signature _____ Date _____

Citizenship _____

Post Office Address _____